

A comparison of the effects of first premolar extractions on third molar angulation

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The development of third molars and their influence on the dental arches has long been of concern to the dental profession. The impact of third molar eruption on mandibular incisor crowding has been the subject of many studies.¹⁻⁷ Causes for third molar impaction and predictions of third molar eruption have also been studied extensively.⁸⁻¹⁰ However, relatively few studies have investigated the effect of orthodontic treatment on third molars.^{11,12} New patients often want to know if third molar extractions will be necessary. Patients usually tolerate the loss of four premolars, yet they may not be as receptive to the loss of four additional teeth. Patients often complain that premolar extractions did not prevent the need for third molar extractions and, as a result, eight "perfectly good teeth" were lost. It is often difficult to predict the fate of the third molars since the second molars of many

orthodontic patients have not yet erupted and the third molars have a limited amount of calcification. Richardson⁸ investigated cephalometric methods for the prediction of third molar impaction, but the results of the study were inconclusive. A study by Garcia and Chauncey¹³ indicated that third molars may erupt more often than previously thought if given enough time. This conclusion was also supported by von Wowern and Nielson¹⁴.

Most of the previous third molar studies have concentrated on the influence that third molars have on the rest of the dentition rather than on the control that the dentition has on the third molars. The relationship between third molar eruption and mandibular incisor crowding has been extensively studied, and the results vary. Separate studies by Lindquist,¹ Keene,⁶ Richardson,^{4,5} Vego,¹⁵ Bergstrom and Jensen¹⁶ suggested that

Abstract

The effect of third molars on the stability of orthodontic treatment has been studied extensively. Yet the effect of orthodontic treatment, particularly premolar extractions, on third molars has not been substantially studied. The purpose of this investigation was to compare the changes in third molar angulation in patients treated with and without extractions. Records of 45 Class I, non-extraction and 33 Class I, first premolar extraction patients were examined. The pretreatment and posttreatment pantographs were digitized, and the angles between the third molar long axes and the occlusal plane were measured. Changes in third molar angulation from pretreatment to posttreatment for the two groups were compared for statistical differences using a Student's t-test. Statistical analysis revealed there were no significant differences in the change in third molar angulation in either group. On average, the maxillary and mandibular third molars showed an improvement in angulation relative to the occlusal plane. The results suggest that factors other than first premolar extractions may influence third molar angulation.

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Key Words

Third molar • Premolars • Extractions • Angulations

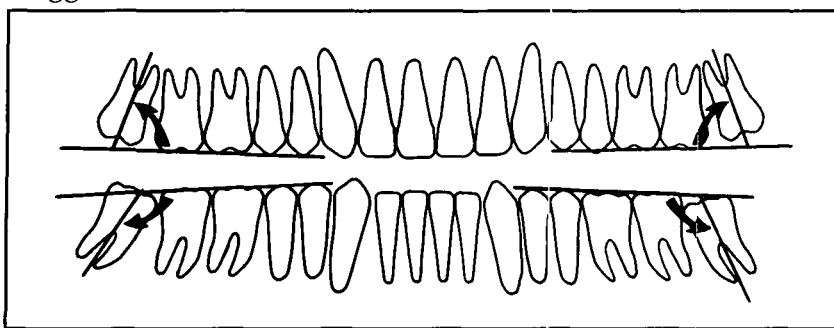


Figure 1

Figure 1
The third molar long axis-occlusal plane angle.

mandibular incisor crowding was greater in individuals with erupted third molars than in individuals with impacted or missing third molars. Other studies, however, have disputed this claim.^{3,7,17-20}

A few investigators have studied the influence premolar extractions have on the third molars. Faubion¹¹ examined the mandibular third molars of 40 orthodontically treated patients. Twenty of these had been treated with the extraction of four premolars and 20 were treated nonextraction. Based on serial radiographic tracings, he found that 55% of the extraction group retained the mandibular third molars in good position as compared to 15% in the nonextraction group. He concluded that the extraction of first premolars provides increased space for the eruption of mandibular third molars.

Richardson^{12,21} also studied the effect of premolar extractions on third molar eruption. In one study²¹ the mandibular third molars of 160 patients were followed longitudinally. Twenty-eight percent of the patients treated with extractions had third molar impactions while 38% of the nonextraction patients had impactions. In another study, Richardson¹² evaluated 48 subjects who had mandibular first premolars extracted as part of orthodontic treatment and 46 subjects who were treated nonextraction. Twenty-nine of the patients did not have mandibular appliances, and the remainder were treated with fixed appliances and round wire only. Richardson's results showed that there was an increase in third molar space in the extraction group. However, she also remarked that factors other than change in third molar space influenced the eruption of third molars.

The studies by Richardson and Faubion involved only the mandibular third molars. Although maxillary third molars are more likely to become impacted,^{22,23} the relationship between maxillary premolar extractions and maxillary third molar impactions has not been extensively studied. The purpose of this study was to investigate the change in maxillary and mandibular third molar angulation relative to the occlusal plane in first

premolar extraction cases and compare these changes with nonextraction cases.

Materials and methods

Pretreatment and posttreatment pantographs of 78 orthodontically treated individuals were examined. All of the patients had Class I skeletal and dental relationships prior to orthodontic treatment. Orthodontic records were obtained from the clinic at the West Virginia University School of Dentistry. Forty-five of the patients were treated without extractions and 33 were treated with the extraction of four first premolars. All of the patients were treated with maxillary and mandibular straight-wire appliances. Pretreatment ages of the extraction patients ranged from 11 years 0 months to 26 years 1 month. Ages in the nonextraction group ranged from 10 years 8 months to 16 years 10 months. All pretreatment pantographs were taken within 2 months prior to the start of orthodontic treatment. All of the posttreatment pantographs were taken on the day the active orthodontic appliances were removed or within 1 month of debonding. All the posttreatment pantographs were taken on the same radiographic unit. All but five of the pretreatment pantographs were taken on the same pantographic unit.

On each radiograph, the long axis of the third molars and the occlusal plane were digitized using a customized regimen of Dentofacial Planner version 5.2 (*Dentofacial Software Inc.; P.O. Box 950, Station A; Toronto, Canada M5W 1G5*). The occlusal plane was determined by bisecting the first molar and second premolar (or primary second molar) occlusion. The anterior angles between the long axis of the third molars and the occlusal plane were calculated by Dentofacial Planner (Figure 1).

The changes in third molar angulation relative to the occlusal plane from pretreatment to posttreatment for each group were compared for statistical difference using a Student's t-test. The angle data calculated by Dentofacial Planner were exported to a Lotus 123 file, and the statistical analysis was performed on a personal computer using SAS. In order to rule out the possibility that the third molar angulations in the two groups were different prior to orthodontic treatment, pretreatment third molar occlusal plane angles of both groups were analyzed for statistical differences using a Student's t-test at the 0.05 level.

For each third molar, pretreatment values were subtracted from posttreatment values in order to obtain the amount of change in third molar angulation that occurred during treatment. An F-test was run to examine the variance of the means

Table 1
Average change in third molar angulation
(in degrees)

Third molar	Extraction Group		Nonextraction Group		P Value
	Mean	S.D.	Mean	S.D.	
Maxillary Right	8.40	15.03	5.59	12.07	0.36
Maxillary Left	8.35	16.54	4.06	11.25	0.20
Mandibular Right	-0.14	8.82	-4.24	10.25	0.07
Mandibular Left	-3.93	10.66	-3.05	11.99	0.74

Table 2
Results of the reliability test for
digitizing errors (in degrees)

Third molar	Mean Digitizing Error	Standard Deviation
Maxillary right	-0.46	0.90
Maxillary left	1.18	1.80
Mandibular right	0.28	2.00
Mandibular left	-1.12	0.80

of each of the third molars in both groups. Then a Student's t-test was performed at the 0.05 significance level to determine significant differences in the change of third molar angulation between the extraction and nonextraction groups. A decrease in the mandibular third molar long axis-occlusal plane angle would indicate a favorable change in the mandibular third molar angulation. An increase in the maxillary third molar long axis-occlusal plane angle would also indicate a favorable change in the maxillary third molar angulation.

To check the accuracy of the digitizer and the operator, five of the pantographs were selected at random and were digitized twice. The third molar long axis-occlusal plane angles were computed, and the mean digitizing error and the standard deviation were calculated.

Results

The results of the Student's t-test comparing the pretreatment third molar-occlusal plane angles revealed no differences between the pretreatment angles of the two groups, indicating that the two groups were not different prior to treatment. The Student's t-test comparing the change in third molar angulation resulting from orthodontic treatment showed no significant differences between the extraction and nonextraction groups (Table 1). The maxillary and mandibular third molars in both groups, on average, showed an improvement in angulation.

The reliability test evaluating the accuracy of the digitizing showed an average error of 0.78 de-

grees. The results of the reliability test are given in Table 2.

Discussion

The results of this study suggest that factors other than extractions could influence the inclination and subsequent eruption of third molars. Bjork¹⁰ and Svendsen²⁴ suggested that low mandibular growth rate, early physical maturity and late third molar mineralization may be etiological factors of mandibular third molar impactions. Richardson¹² stated that the original space conditions in extraction cases may have more influence on the eruption of third molars than do the premolar extractions. Forsberg²⁵ proposed that extraction cases have a larger tooth size/arch length discrepancy than nonextraction cases and that this discrepancy may still make third molar impactions more likely in extraction cases than in nonextraction cases.

The initial angulation of the third molars may also influence their subsequent eruption. Richardson²⁶ found that third molars with a small degree of angulation erupted earlier than those with steeper angulations. She, like Bjork and Svendsen, believes that mandibular growth is a contributing factor in mandibular third molar eruption, but its exact role is uncertain.

Like previous third molar studies, this study did not reveal any basis to predict the eruption of third molars since third molar angulation improved whether or not teeth were extracted. Also, even with this improvement in angulation, third molars may still become impacted. Consequently,

it may be prudent for orthodontists to advise patients that premolar extractions will not guarantee that the third molars will erupt and have sufficient space to achieve good alignment.

All the patients in this study were dentally and skeletally Class I. Therefore, there was no need to protract mandibular molars in order to obtain a Class I molar relationship. If the study subjects had been Class II dentally and mandibular molar protraction had been used to correct the molar relationship, an even more favorable change in mandibular third molar angulation may have occurred. How premolar extractions and Class II molar correction affect third molar angulation warrants further investigation. Perhaps the type of mechanics used and anchorage considerations have more of an effect on third molar angulation than the actual extraction of first premolars.

Conclusions

This study data imply that orthodontic treatment involving premolar extractions does not improve third molar angulation any differently than non-extraction treatment. Third molar

angulation improved regardless of the method of orthodontic treatment. However, an improvement in angulation does not necessarily mean that third molars will erupt in good position. One can conclude that factors other than first premolar extractions influence third molar angulation and eruption. Therefore, it may be prudent for orthodontists to inform their patients that premolar extractions may not prevent the need for third molar extractions in the future.

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